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ABSTRACT

This paper reports on an interview study conducted with 80 science teachers in 12 secondary schools across Australia. The study was one component of the Science Education Professional Development Project, charged with developing a national strategy for enhancing the professional development of science teachers. Initial interviews were conducted with 30 science teachers in 6 schools. Teachers were asked to talk about attitudes towards their work and to address the impact of policy. A second wave of interviews in seven more schools focused on developing and testing the significance of issues and themes which emerged during the first wave. Subsequent to the presentation and interpretation of a single case study, it was argued that many science teachers have a weak professional identity and feel "loosely connected" with: science and scientists; a professional knowledge base; professional development; collegiality; a sense of efficacy; professional identity and professional norms; recognition; status and evaluation; and professional standards. Implications for a professional development strategy based on these loose connections include strengthening both the professional community of science teaching and the relationship between professional development and career development. (Contains 29 references.) (LL)

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Loose Connections: The Context of Science Teachers' Work

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Paper presented at the Annual Meeting of the American Educational Research Association, San Francisco, April 1992.

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Loose Connections: The Context of Science Teachers' Work

Lawrence Ingvarson and John Loughran

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Introduction

There has been no shortage of reform initiatives in Australian education over the past twenty years. Some have seen the solution in terms of new curricula frameworks, student assessment and school organisation policies. Others have focused on administrative restructuring and devolution of governance to school-site councils. Too many have neglected to study how this educational policy buffeting affects the condition of teaching itself as an occupation; its attractiveness as a career, the quality of work life and practice for teachers, and particularly the quality of engagement they share with students in the central business of learning. The latter is arguably the basic reward or 'work condition' for teachers.

The evidence indicates that this period of mainly government initiated reform has been paralleled by a decline in the condition of teaching as an occupation that places all the other reform initiatives in jeopardy (Hull, 1990; Abbott-Chapman, 1991; OECD, 1989). It seems as if we may need to rethink our approach to reform if it is to enhance, rather than undermine, the quality of the most important resource in our school system, our teachers.

Only recently has reform policy come to focus more directly on teachers and teaching. There have been several recent reports that reflect this trend, perhaps the most notable of which are the National Board for Employment, Education and Training reports *Teacher Quality* (NBEET, 1990), *Australia's Teachers: An Agenda For the Next Decade* (NBEET, 1990), and *A National Professional Body for Teachers* (NBEET, 1992). These reports are a recognition that in any final analysis teachers are the most important educational resource possessed by our school systems, but that our schools and teachers' careers have not been managed as if we really believed this to be the case. How well do we understand that resource, and the conditions that will need to be in place if we are to reproduce this resource in the future?

The Science Education Professional Development Project

This paper is based on an interview study with eighty science teachers in twelve secondary schools across Australia. The interview study was one component of the Science Education Professional Development (SEPD) Project. The Project was commissioned by the

Commonwealth Department of Employment, Education and Training as part of its Projects of National Significance Program. Its brief was to develop a national strategy for enhancing the professional development of science teachers.

No stipulations were given about the meaning of "strategy" in the context of the brief. Did it refer to an innovatory kind of in-service education course for science teachers to be repeated across the nation, as the the Early Literacy Inservice Course had been for thousands of teachers? That was how we viewed the task initially; to develop a course designed to incorporate as much of the rich bank of research on effective models of profesional development as possible (e.g. Sparks & Loucks-Horsely, 1990; Fullan, 1991). It did not take us long to see that the conditions in the mid-1980s that favoured the development of in-service programs such as ELIC, no longer applied. (Nearly 40,000 teachers completed ELIC courses between 1985 and 1990 at a cost of more than $20m to Commonwealth and State Governments.)

We came to see the task more in terms of policy analysis, defined by Wildavsky (1979) as the creation and crafting of problems worth solving. The more relevant task was to assist policy formation by defining more clearly what the problem was that needed to be solved in the first place. In other words, our priority shifted to understanding better what the problem was that the strategy for the professional development of teachers needed to address.

The interviews with teachers formed one part of the work that we did to identify the problem and to clarify what the purpose should be for a national strategy for enhancing the professional development of science teachers. We also worked with employing authorities, the Australian Science Teachers Association and teacher union leaders, among others.

Background to the interviews

When we started the interviews late in 1990 we were aware that there was disquiet about the "condition of teaching". Australia was starting to share the concerns about the future of teaching itself as an occupation that had given the Americans such a scare in the early 1980s (National Commission of Excellence in Education, 1983; Carnegie Forum on Education and the Economy, 1986), and which had led the OECD to initiate its activity on *The Condition of Teaching* (OECD, 1989). There was concern in Australia about morale amongst teachers generally (Hull, 1990), the ageing of the profession, the declining ability of teaching to attract abler recruits (NBEET, 1990), and the loss of many able teachers to alternative careers. In particular, there was increasing concern about the proportion of the ablest graduates from secondary schools who were being attracted into science faculties in universities and science education courses in Colleges of Advanced Education. Any

national strategy for the professional development of science teachers that did not address these issues about the condition of teaching risked being irrelevant.

We were also aware of movements in the industrial relations area such as those stemming from the report *Australia Reconstructed* and the "structural efficiency" principle adopted by the Industrial Relations Commission in its National Wage decision of August 12 1988. Since the 1970s teachers' real salary levels had been on the slide. During the 1980s teachers salaries "were locked into a downward spiral over the period of the Accord" (Durbridge, 1991). Changes in the value of teachers' work and comparisons with other professionals could no longer be used in making cases to Industrial Relations Commissions. The Structural Efficiency Principle changed the game. This amounted to using industrial awards as a lever for workplace reform, taking them well beyond the traditional areas of wages and conditions into areas traditionally regarded as managerial prerogative (Curtain, 1991). Pay classifications and basic conditions of employment were to be reviewed to establish skill related career paths.

For teachers, this "Award Restructuring" meant the introduction of more tangible incentives for professional development than in the past, at least in theory. The manifestation of this recognition was to be a new Advanced Skills Teacher (AST) Classification. These new career positions were designed to keep more of the best of our teachers close to students. They were designed to enhance the status of teaching in the school and to provide tangible recognition for demonstrable advances in a teacher's knowledge and skill. Career development and professional development were thereby to be integrated. Strengthening the link between the two was to be the main vehicle for increasing the 'productivity' of the education system. Translating this aspiration into practice has been more difficult than many anticipated (Chadbourne & Ingvarson, 1991).

Not so readily acknowledged, it also meant that the teaching profession would need to learn how to introduce a system of teacher evaluation. Unions and employers had to learn how to set standards about what kinds of practice constituted advanced knowledge and skill. The literature on award restructuring was vague on how standards should be arrived at and who should be involved in establishing them. Much work also needed to be done on how teacher evaluation could be carried out in a valid, credible and fair way. There was an extensive overseas literature on teacher evaluation and the acute complexities involved in implementing such a sensitive innovation, but only limited attention was being given to its warnings; especially those related to the necessary lead-in time, the cost, and the need for broad-based consultation and discussion across the profession. We wanted to know teachers' views on evaluation and the introduction of the AST classification. Award Restructuring seemed to be the only means available to redress their concerns about status,

and the lack of recognition and reward in career terms for demonstrable advances in teaching skill.

In developing a strategy for professional development, it was obviously important to talk to science teachers: to ascertain their views on the quality of what they had experienced, what they wanted in the future, (and what they thought the Federal Minister for Education needed to know if the country was to become "cleverer" or more "intelligent"). But our interests went further. We wanted to understand, from the science teacher's point of view, the context within which they worked and the factors that helped or hindered them doing their jobs as well as they would wish.

It is obvious that if we want to do something about the quality of science teaching then we must understand first what shapes teachers' attitudes to their work and the "quality of worklife" as they perceive it (Louis & Smith 1990). There is not much point organising quality in-service programs if teaching is becoming less and less attractive to able graduates as a career and if experienced teachers are leaving or losing heart because they do not feel that the returns in terms of status and conditions are in balance with what they invest in the job.

What were teachers' views on the introduction of the new AST classification? What *was* the connection between professional development and career development for teachers? What conception did teachers have of 'development'? - and development toward what? Was development just a 'good thing' in itself? Was it some growing sense of empancipation, as the action researchers argued? Was there a professional consensus, among science teachers in this case, about what teachers needed to get better at? Who did set standards for teaching? Who should?

A new career path for *practicing* teachers seemed like a good idea. The careerlessness of teaching has been identified as a major 'structural inefficiency' in the education industry for many years. But if this skills-based concept of career development (Bacharach, Conley & Shedd, 1990) was going to be introduced effectively, rather than a discredited merit pay or career ladder scheme, it seemed to require that the profession itself grasp the responsibility, one that it was so habituated to leaving to others, to set standards for what an Advanced Skills Teacher should know and be able to do.

The phenomenon of "disengagement" from any serious participation in educational activity in classrooms is well documented in the USA (e.g. Sedlak et al., 1986; Cusick, 1983; Powell et al., 1985) where "friendly relations" replace active engagement in learning by teachers and students. Australian teachers were more likely to be exhausted than disengaged, according teacher stress figures (Rowe, 1987) and work value cases

Methodology

In order to develop a clearer conception of what needed to be done, we conducted an initial "wave" of interviews late in 1990 with thirty teachers in six schools in five of the eight states and territories in Australia. Each interview lasted about forty-five minutes. We asked teachers to talk about their attitudes to their work, their students, their sense of status and career, their workplace, their department, their views on what helped or hindered them doing their jobs as well as they would wish, their professional development, their approach to teaching science, the evaluation of teaching, and the impact of recent system-level policy.

These loosely structured interviews aimed to understand contextual influences on teachers' work through the eyes of science teachers themselves. They were intended to be exploratory and hypothesis-generating. In-depth interviews were the most appropriate method because our purpose was to try to represent the way science teachers viewed their work and the impact of policy. The second wave of interviews in seven more schools focussed on developing and testing out the significance of issues and themes which emerged during the first wave.

There is no such thing as a representative sample of schools, especially in a study of this size, but we did ask system people in the first wave to suggest schools that were "ordinary run-of-the-mill" schools. All were government schools. In the second wave we included one Catholic systemic school and one independent school, noted for its innovatory staff development and evaluation programs, to facilitate the process of interpretation and hypothesis-generation. If time and money had been available we would also have conducted one more wave of interviews, and to add a classroom observation element to the study.

The interviews were transcribed and returned to teachers for correction and comment. Few changes were made by teachers. The software program Ethnograph was used to code the interviews. A set of thirty codes was used drawn from a range of literature on the context of teachers' work (McLaughlin, Talbot and Bascia, 1991; Johnson, 1990) and the quality of teachers' work life (Louis & Smith, 1990).

A Case Study of a Science Teacher

In this paper we will be reporting on one of the main interpretations that emerged for us from the interviews. We want to present the theme through the device of a single case study. It is based on one of the interviews we did with science teachers. We have used this case study on many occasions with many different groups of teachers. We ask them to read it and to suggest an appropriate title. The response is always much the same.

Everyone says they recognise Mike Abbott. There are many Mike Abbotts around in our schools they say. There are more than there used to be, argue others. Many readers of the case study swear that they actually know who Mike Abbott is, and that he is teaching in their school. He is not, but we would want to argue, based on our eighty interviews, that there many science teachers who share his attitude and his situation as a result of the way we have managed teaching as an occupation for many years.

Mike is not 'representative' of the teachers we interviewed. No one was. No one could be. But we have taken the unusual, and perhaps unwise, step in this paper of restricting our presentation of data to material based on our interview with him. We have already written papers based on more 'rigorous' analyses of the interview data using the codes we put into Ethnograph (Loughran & Ingvarson, 1991, 1992). But another part of the truth is that after listening to many of these interviews and going back over the transcripts, this was the one that 'clicked'. This one seemed to crystallise so many common threads and to encapsulate so many of the issues that recurred in various forms in most of the interviews.

The single case can often capture the interest and create discussion about the issues more effectively than a syntheses of many interviews. For the SEPD Project, it was vital that we draw the attention of many parties to the condition of teaching. This was the interview we would have chosen for the policy makers to read. We would have wanted to say to them "If you want to develop a strategy for enhancing the professional development of science teachers, it has to be capable of reaching Mike Abbott. Never mind the National Curriculum Statements and Frameworks. Those policy documens have their place. But the chances of them influencing Mike Abbott's practice are very slight. He may be teaching science for another thirty years. Many more Mike Abbotts are being recruited every year into teaching. We need a strategy with the capacity to make a difference to the context which shapes the self-perception, the attitudes, and skills of the Mike Abbotts in teaching."

Mike Abbott, Science Teacher

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there are many science teachers who share his attitude and his situation and that this is partly a result of the way we have managed teaching as an occupation over many years.

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We would want to say to them, "If you want to develop a strategy that is to have some chance of enhancing the professional development of science teachers, it has to be capable of reaching the Mike Abbotts in teaching. Never mind the National Curriculum Statements and Frameworks. Policy documents such as those have their place. But the chance that they will influence Mike Abbott's practice are very slight, given current levels of investment in professional development and career structures. He may be teaching science for another thirty years. Many more Mike Abbotts are being recruited every year into teaching. What we need is a strategy with the capacity to make a difference to the self-perception, the attitudes, and skills of the Mike Abbotts in teaching."

Mike Abbott: Background

Mike has been teaching science for ten years. This his fourth high school and he is back in the state capital after the usual spell that many young Australian teachers spend in small town high schools. He has just moved to this school in a middle class neighbourhood, after three years in a 'tougher' city high school. Moving to 'easier' schools is a kind of 'Claytons' career path for many teachers.

He teaches classes from year 8 & 9 science, year 10/11 chemistry, to year 11 biology, as well as an elective on electronics and computing - 32 out of 40 periods in the week. His major in his B.Ed. degree in a college was Physics, but he has rarely had a opportunity to teach it. Like so many of the science teachers we interviewed, it was almost a way of life to face the pressures of teaching outside his immediate field of subject expertise, and the

consequent limitations this placed on the range of teaching methods that he felt confident in using.

> Like computing at the moment, I've got a level 5 computing class. Now, although I've done some computing and done some information processing, due to letting my computing lapse for a few years, I've got to be one step ahead of the kids all the time. You know, what is coming up next. I've got to make sure I know before the kids actually do it. Though at times that gets very tiring.

Career-Status

We were interested in Mike's perceptions of the status of teaching and what it meant to have a 'career as a science teacher'. How did he see the status of science teaching compared with other subjects, or other professions? Like most of the teachers we interviewed, Mike admitted that the general atttitude in the community towards teaching is one of lack of respect.

> Well, reading books and looking at Time Magazine - where do they put you? They put us behind used car salesmen. So, as far as our social standing goes, it's extremely light. And even in the community we live in, parents don't put a hell of a lot of importance on a teacher. We are really the dogsbody and that does disturb me. I've seen that, over 10 years its got worse and worse in my view.
>
> *Do you think they value, put more value on science teachers than other teachers - the parents and the public? Or less, or the same?*
>
> Probably, they might think you've got a bit of nouse because you're a science teacher, that's about all, but as far as value, you're just a teacher. Teachers are not valued in the community.

Despite this, Mike thinks that his work is important and he "feel[s] proud to say...[he's] a science teacher". The majority of teachers we interviewed admitted, that in social situations outside work, they avoided saying they were teachers "to avoid getting attacked".

Mike was pessimistic about his prospects for promotion. We asked him if he thought of himself as having a career as a science teacher.

> "I'd like to. In 10 years I've made a start haven't I. I suppose I've got some huge chips on my shoulder at the moment as far as how far I can go in science teaching.
>
> *Why's that?*
>
> I feel as though . . the Ministry/Department has made a big push for females in education. There are certain things going on in the Department, like females being taken out on a course on how to fill in a promotion slip to apply for Deputy Principal. Well this is my 11th year of teaching and no one ever has told me how to fill out a promotions slip or anything like that. Yeah, I can see that women in education have probably had a back seat for quite a long time and they're trying to push women up the ladder that's for sure, but I get very discouraged with that because I know my prospects of going any further, or even to (Head of Science Department) level, is probably not a reality. I'm going to be stuck in the classroom for every after.

One of the reasons Mike felt 'stuck' in his career was because he had a B.Ed. from a college rather than a B.Sc. and a Dip. Ed. from a university. It was not that the he felt the

college degree was a poorer preparation for teaching. He just resented the fact that it left him with no career choices, if he ever wanted to make them.

> I've got a Bachelor of Education behind my name and that's all it means, that I can teach science. It doesn't mean that I can go out to a mining company and be a chemist or anything like that. It makes me, you know, a teacher and that's it, that's all my qualifications are in. And I feel as though if I went the other way and had a Bachelor of Science and did my year to become a teacher afterwards, I just feel as though there would be more scope for me if I wanted ever to change.
>
> *Do you think those who do the three year B.Sc in university and then the Dip. Ed. regard themselves as being better prepared, or poorer prepared?*
>
> That's a hard one. The people I went through with that may have done a Bachelor of Science and become teachers are no longer teachers.
>
> *Can you have a career as a science teacher within the classroom without promotion?*
>
> Yeah, I can, but I'm at the stage now where my salary has got to the highest that it can get and I think after teaching for that long in the classroom my ideas of what I think of how a school should run are well developed. I get very frustrated sitting in that classroom now knowing that there are people organising what I do in my classroom; well not actually how I teach in my classroom, but when, what and how I do things. Things in the school plan that I totally disagree with and for a lot of good reasons think should be working a different way. You know, the running of the school, not just the science, the whole school. . . .
>
> So you know, if I could sit in my classroom and teach science and know that there are people in higher positions doing a better or a reasonable job, I suppose I could sit in my classroom till I was 65, but that to me is not happening, and never has happened.

Professional development

Mike feels established in his teaching practices and doubts that he would benefit from further professional development. "[After] ten years you know the way you teach. I'm not going to change a lot now".

We were interested in Mike's ideas about 'development'. What conception did he have of the ways in which the quality of his science teaching might be further enhanced? If he did not have such a conception then the prospects of Award Restructuring and the introducton of the AST having an impact on his 'productivity' were questionable.

> *Do you feel there is any area of your teaching where your performance would be enhanced if you did have some inservice training or professional development? Do you basically feel a need for it at this stage in your career? For inservice, professional development?*
>
> Probably, as I said before, it's not going to make a lot of difference to how I teach. I think that's established. It's well past that now, but as far as looking at other teachers and probably critically looking at myself as a teacher, etc. and seeing what other good ways of teaching etc, there are always things you can learn.

Like most of our teachers, Mike has received minimal professional development in science in the last two years (75% had less than one day on science in the past two years). "The

only thing that I go to is Moderation Meetings in the upper school...and that's it." Nothing in science.

Had Mike made any changes to the way he taught science over the years?

> Yes. Yes. Probably the, . . .probably reinforcement of particular concepts you go over, where you, where I probably used to think telling the kids once or twice or may be three times about a particular concept, and think they know it. Now you've got to go over it quite a few times. I suppose, you know, the important concepts. I probably reinforce a lot more and may be try maybe half a dozen different ways to get one or two concepts over, to make sure that the kids have got it. . . .

Was he aware of any major changes in the way science is taught over the past ten years in Australia?

> I'm not aware of any major changes. We've been through the new Ministry *Science Curriculum,* where the actual emphasis on assessment and things like that has probably changed how we try and record a particular grade for doing a particular unit. That's changed. The actual teaching of it, you know some of the particular activities I did ten years ago, I'm still doing today. So the content I don't think has changed. Probably the assessment has changed.
>
> *Well have there been any significant attempts by people outside of the school to improve science teaching over the past ten years?*
>
> Well, when we had, . . . the curriculum branch in the ministry, it had some science people in it, well there was the physical science. Then they had people in there writing units for us, and even the unit books that we've got, they were good, although maybe the actual content hadn't changed, but you know the work sheets, etc., yeah, they were good. But we don't have that now. It's all changed. There's nothing there at all. So, you know even for the first year outs, I don't think they even have advisory teachers there now, so I'd hate to be first year out, that's for sure. As far as getting any help from the Ministry, there's none.

Mike says that he had found advisory teachers of great assistance in guiding him through, during the early stages of his teaching career. "I used to have the advisory teacher come around about once or twice a year and they were a great help." At present, Mike's main source of information regarding good teaching practice seems to be derived from informal exchanges of views with other teachers. "It is good to talk to other science teachers, just how they're getting on and what problems they're having, what things they've found out, etc." Although he admits that professional development may benefit teachers *entering* the profession, he personally thinks that he is "past it".

> *But after 5 years you feel the need for professional development falls away?*
>
> I would say so, I don't think . . I'm not going to change my way of teaching. As I said, I look at other teachers in here and I'll pick and choose the bits I want. As far as changing the way I teach, I'm past it.

It seemed from interviews with many people like Mike that we were in a transition period so far as the locus of authority over science teaching and professional knowedge and development. The old forms of bureaucratic control had been weakened. New forms of control over knowledge and the evaluation of teachers' work had not yet developed in any

clear form. Mike did not have a conception of a professional model of control. Administrative reorganisation and devolution in his state meant that the leadership position of Science Superintendent in the bureaucracy had disappeared - replaced by a 'leaner' corporate managerial group.

Like many others, Mike felt the loss of someone 'up there' acutely. The bureaucracy had been the top of the career structure. He saw value in the superintendent role and recalls how supportive superintendents had been to to him as a teacher at the start of his career.

> "There was someone you could talk about science to, where you're heading as a science teacher, what you should or shouldn't be doing".

Mike says that he "would like to have a superintendent that [he] could actually talk to." Mike said that he now lacks access to any formal links with administrative planning and policy, through which he could express frustration regarding the progress of his career. It was a period of considerable uncertainty for teachers like him in his state and partly explains the high level of strike activity that had been taking place in that state during the year before our interviews.

The workplace - collegiality

Discussions in science department meetings were more concerned with administrative matters than teaching.

> The meetings are more into making sure you get the assessments in on time ...getting particular school things that we're doing across to other people...[so] they know what's going on. It's not the actual content of teaching...how you should teach a particular concept.

We asked Mike if the science department had a common view, or philosophy, or theory on the teaching of science

> No. Oh, we'd have a science policy I suppose, what our educational aims are. I should know it but I haven't read it. I've looked at it, yes. Yeah, there is, I would say, . . .we've got a policy on what our educational aims are.
>
> *Is that an actual policy or?*
>
> I don't think so.
>
> *And does it get revised very often, or do people know what's in it, or?*
>
> You've hit a bad point here. I don't honestly know what's in it. But I, again that's another time factor. I just don't have time to sit down and look at those things and see if those airy fairy statements that they have in them are up to date and right. I think Bill (the Dept. chair) would probably look at it more than I do.
>
> *Does it get talked about much, the science policy, the science department policy?*
>
> No.
>
> *So really its not....*
>
> Well I think if there was something that really looked out of place I think Bill would bring it up and talk to us about it and say, you know, we've got this particular aim in our

science policy that we need to upgrade or something like that and he'd talk about it to us, give our input and make a decision.

How strong were the mutual influences of teachers in the science department? Or did teachers just 'do their own thing'?

Well, over the years, has belonging to a school science department, become more or less important to you?

Oh, I don't know. I just take it as it's part of the particular structure we have and that's it. I think it's good to have other science teachers around you, so, you know, there's many different views on how to teach science and, you know, there's very much a lot of individual ways of getting your point across. I think, I dunno, I accept it that a person teaches different to me. That's about it.

Can we talk now about how the way you do your job as a science teacher is influenced by your colleagues in the science department here. Who would you say in this school has helped you most or had most influence on the way you teach?

In this school?

Yeah.

I don't reckon anyone's had an influence on how I teach in this school.

Well looking back over your career generally, what type of people have had most influence? Is there a certain type of person in the school who's had most influence on the way you teach science?

Well, starting in a district high, I was the only science teacher there, and the science department was sort of a little bit out from the rest of the school and no one ever came there, so I had to learn myself as far as that goes. I used to have the advisory teacher come around about once or twice a year and they were a great help -- actually saw someone else who taught science. So as far as a starting point, there was just myself. I have seen -- when I was at my last school, which as far as the socio-economic area that it takes in, it's probably worse than this one -- how people handle it. Yeah there were a few teachers there that I sort of looked at, and how they taught and how they ran things.

What help do you get from the science teachers here in doing your job? Put it another way, do the science teachers in this school work in isolation from each other or do they sort of form a collegial support group, and how much sharing is there of things?

Well, we have science meetings. As far as the actual in classroom, how you teach and how you put a particular point across, no. Let's say Bill and Don have been around since at least 20 years or so, so they're not going to, I don't know, how they teach in their rooms is up to them. I, sort of, probably may be, don't have a look at them and try and see what, how they do teach. That's probably something if I don't do, I probably don't.

Have you ever seen them teach?

Probably not. No, because as I say, I'm teaching most of the time they're teaching and you look at it as though, if there's not kids jumping out the windows, they must be doing something right.

No, I think I've been 10 years out, . . . , but 10 years, you know, the way I teach, I'm not going to change a lot now.

Right. So going and seeing other teachers. You don't feel as though you'd learn a lot?

No, I can't see what they can show us now.

Mike did not seem to see any relation between standards of quality teaching and his *personal* style of conducting classes. When asked about restraints to good standards of

teaching, he cited class sizes and stated a need for "a big supply of money and being able to ... conduct bigger experiments."

Science and scientists

There seemed to be two quite separate worlds, to our interviewees, between those who 'did' science and those who 'taught' science. The lack of connection between the scientists and science teachers was a striking feature of our interviews. We were surprised that most of our teachers did not think that teaching science was in a sense still doing science.

Like almost all of the teachers we interviewed, Mike has minimal contact with the "real world of science". When we asked how many 'real' scientists they had talked with over the past year, most teachers expressed surprise at the question. Mike has only occasional and informal contact with scientists.

Do you think of yourself as a scientist?

I'd like to.

You think of yourself as a science teacher I suppose, but as a scientist?

Yeah, yeah I suppose I'm getting greener as I get older, a hell of a lot more greener as I go.

Well would you make a distinction between say real scientist and people who teach science?

Yeah, only in the thing that, well I'm sort of a jack of all trades, I go right across the spectrum of science, and I'm meant to know everything about . . . , but of course I don't. A real scientist can pick out their little niche and, you know, they can get into that little area and go into it and develop something quite good, where I can't. I'm just always on the surface looking at things and looking at the overall general view of it. So I suppose I'd make a distinction there. You know I'm not the pure scientist

Do you have the opportunity to talk with real scientists in areas where you are teaching?

Only if someone came to the particular school and gave a lecture or something like that.

When we asked Mike if it was necessary for teachers to meet with working scientists as a means of improving science teaching, he replied "yes, it gives you a better view", but he had not thought of it as a priority. Mike is not a member of his local science teachers' association and does not subscribe to scientific magazines or journals. He ascribes his failure to join the asssociation or to subscribe to journals to lack of funds, "Economic factors are the only reason ... I mean, if I had an unlimited supply of money, yes I would [subscribe]."

Evaluation of teaching - the changing locus of accountability

We were interested to know if there was any evaluation of teaching or peer review in the science department. Mike said that the only recognition he receives for his efforts is from the kids.

> [that's] the only reward I get and I suppose, if anything, that's the only thing that really keeps me in teaching, that little bit the kids bring back to us.

What forms of accountability did Mike experience? At present, Mike says he does not feel accountable to anyone within the science department, the school or the system for the teaching methods he uses. Regarding the teaching methods of his colleagues, Mike said that individual science teachers taught science in their own particular way. "How they teach in their rooms is up to them." On asking Mike whether there was a shared set of professional norms or expectations amongst members of the science department, he remarked that there was a degree of flexibility in the teaching of science and that the science department did not have a general common philosophy, "I don't know, I accept that a person teaches science differently to me, that's about it."

We asked Mike if anyone ever evaluated his teaching?

> No, not that I know of. I suppose the kids do every time they come to the door. I think it's one of those things, if you get a complaint, naturally then you know you're doing a bad job. If you're doing a good job you never ever hear about that.
>
> *Does any one care about the quality of how well you're teaching?*
>
> If you're doing a bad job, yes they would. I would say if you were doing a bad job you'd know about it. If you're doing a good job you will never hear about it. So I think I'm doing a good job if no one comes and sees me. It's as simple as that.
>
> *So in a sense is it left up to the kids? If the kids don't complain, the teacher could be doing a bad job, but if the kids don't complain, no problem.*
>
> Yeah, there's probably that, that probably could happen.
>
> *But it could be that teachers do nothing wrong and no one writes a complaint, but not be doing anything in terms of good quality practice. Is that possible within the present system?*
>
> I think it is. You know, because different teachers teach in different styles. I've sat through a lesson, God knows why I ever sat through it, when I was on prac and the kids did all their work out of a textbook and the teacher sat up the front. And his major objective was that they didn't talk so they must be doing their work. That's completely different to my views, but yeah, I suppose it is, and if the kids are quiet, there's no hassle, I suppose yeah. But it's a very hard one to judge because who's going to come and judge the teacher? You know if the teacher that did that job there, if I came and judged it I would probably rate him very low. Whereas someone else who looks at, you know, you've got the kids quiet, and their heads are in a book, might judge him very high, so.....

It seems that ten years of teaching experience has not given Mike any confidence that there might be a professional consensus about counts as quality teaching and learning in science. Mike concedes that some sort of self evaluation, as well as evaluation of teachers (by

teachers), could lead to an improvement in the quality of science teaching. However, Mike argues that the observation of colleagues happens rarely because of lack of time,

> "it's a time factor you know...to be able to sit down and take time to watch. Watching for one lesson wouldn't do a hell of a lot".

Standards

We were interested in the standards teachers applied to their own work. When they taught a 'good' lesson, what made it good in their view? We were interested in the sources to which they referred when making judgments about their teaching. Did they refer to professional norms or standards, or science education research, or colleagues, or any other possible reference points? We approached this topic by asking teachers to talk about a favourite lesson, one that they believed to be successful and effective.

> I look at it as a day to day sort of thing. Sometimes you walk in here and say 'gee I've had a lousy day and nothing's got across'. And other days, think, 'gee that was a good day.' I got some points across and I think that the kids have learnt a lot.
>
> But as far as a particular lesson is concerned, making the hydrogen bomb, which is that thing up there, which I actually made. I tend to, I didn't show all my classes that. If they knew, . . although it comes along into chemistry when you look at elements and look at hydrogen, etc. The kids will always want to see that. Because you explode the hydrogen, and you can build that lesson right up. You can talk about the oxidation of the hydrogen, etc., and you can look at the chemistry and that and the kids know darn well something's going to happen to this thing. They will be interested and want to know what is going to happen. And I suppose on that, the hydrogen bomb itself actually works with say, depends on how much hydrogen I put in it, let's say about 3 minutes. They all keep quiet, listening for the whistle and everything like that, and I've got my ear muffs on, and there's the intensity of that for 3 minutes. But to build that up, I can spend probably 25 minutes building it up, and then after it has happened.....
>
> *How do you mean building it up?*
>
> Building up the work while, . . get the kids. . . 'OK we're going to make a hydrogen bomb. We're going to explode something.' You know, and go on - 'OK, how do we displace, or how do we get hydrogen into the container? Because it's lighter than air? OK, displacement of water. So that means hydrogen is lighter than air, it's going to rise up. You know, we can go through the procedure of setting it up. And also, OK, what's going to happen? OK, if it's going to make a bang, and a sound and all the rest of it, What's actually happening? Well you look at the hydrogen gas and combine it with the oxygen gas. And what's it going to make? OK, hydrogen and oxygen, you're going to make water. So we can go through that before we even, . . .You know, this thing's sitting out the front there and it really grabs their attention. And, you know, after you've been all through that, and then you set it up and do it, hopefully the darn thing works. It usually does. The kids . . . actually a kid got caught last year. You know I was waiting there at 3 minutes and it didn't go off, and he said, "Oh this is hopeless, it's not going to . . ", that's as far as he got and it went BANG and he just about fell off his chair. It couldn't have happened at a better time. So, that really got him. You know I've done a number of good lessons with that.
>
> *So, would you say that counts as good practice, if some asked what's good science teaching practice for you then, that would be one of the lessons you would.....*

Oh yeah, definitely because it grabs the kid's attention. OK, they're going to do something and because they're, they want to see it happen, they're going to sit down and listen. OK, what's going on? You know, why is this going to happen? I suppose it's . . . well it's a discovery approach. There's an observation that's going to happen . . . OK, let's make some predictions before . . or we'll make some inferences of what is going to happen.

If we had had more time for these interviews we would have wanted to probe Mike further on the kind of underlying model he has for quality science teaching and learning.

Sharing ideas

How accessible were teachers' ideas and best practices to each other? What openings were there to learn from each other and to help each other through observation, feedback, and discussion about each other's teaching?

And have you ever demonstrated that lesson to other science teachers? Have they asked you to come and see it, or?

Oh yeah, I've had a few, well have them look in here or whatever and if anyone wants to use it they can.

But do they actually sit down and observe the lesson and ....

No, not the whole lesson, no, no. As I said before, you don't have time for those sorts of things.

Do you ever compare your performance against that of other teachers or against theories or models of exemplary teaching, in fact any standard of quality teaching?

I suppose you know after spending three years in the country district high school, going to a senior high school, I sort of worried about how good a teacher I was compared to other people. And even when I came back to the city after being in the country, after hearing about, you know, 'oh yeah it will be completely different in the city,' I suppose I was a little bit hesitant and probably looking at other people and trying to rate them on a scale compared to myself. But I think I'm well past that now. I think, well the teachers we've got here do a good job, they do it differently to me and you've got to accept that. I don't try to rate someone as being a better teacher than someone else. They're here trying to do a job.

What basis do you use to determine whether a lesson is particularly effective or not, or whether you're doing a good job?

Oh, the kids. You can, you know, tell when you've done a good job and when you haven't. And that is a day to day thing. There is a lot of factors in that. It could be the kids have come from another particular lesson where they've been either bored out of their mind, or they've played up, or they've had Phys Ed, or, . . .That is honestly a day to day thing and, depending on what they've done, or if they've been to the canteen and they've all had their sugar meal of coke, and they're all hyperactive. And you can, oh well, I reckon I can judge when the kids have felt they've learnt something and when the kids have felt they've, well maybe it didn't go down too good. So, it's a day to day thing. And hopefully, it's mainly, they walk out of here with a good feeling rather than a bad feeling.

Well, it's sort of a side track, but where can science teachers go to see good examples of good practice in the profession?

What should I say to this, come in my class! No, I don't honestly know. As I said before, may be your first, second or third year out, it may be if they could get them together and

go and look at some particular demonstration lessons being done. I suppose that's one way to do it. Back in the college we used to go on demonstration. You know, look at particular lessons. I think they'd be more effective if you were actually teaching when you're out there. But again, I think someone would have to set that up and, I think it would be worthwhile, but there'd have to be a bit of time, a bit of effort, and, of course, a bit of money put into it.

Evaluation and the Advanced Skills Teacher

We also approached the question of the evaluation of teaching by asking Mike about the criteria to be used in setting standards for an Advanced Skills Teacher, and who should be involved in that process. Were there any reference points or professional norms that could be turned to, now that the superintendent or inspector role had been abolished?

According to Mike, establishing the criteria and undertaking responsibility for the selection of ASTs is a very complicated issue. He seemed to doubt that it could be done.

I don't know. How do you define an advanced skills teacher? Is it someone who's been in the classroom 25 years and probably knows it all back to front, but then sits at his desk and doesn't do anything, or is it someone who's three or four years out and runs around like a hairy dog and probably, as far as concepts go, the kids probably don't learn anything.

Well, who should set the standards of what counts as good quality practice? Who should set the standards of what counts as good science teaching?

I suppose you'd have to, I hate the word, set up a committee where they'd have to have certain criteria that they would I suppose set up and then go through with particular people and try and re-vamp it and get a criteria that they could then work under. Then a teacher can look at that and say, OK, if I'm going to be a science teacher I have to fit in this criteria - that I've to, you know, be able to conduct a prac, be able to talk about certain things, or what ever. I don't know, whatever you had in the criteria, you know.

Who should be on that committee, set up that .....What type of people?

I would say it would have to be someone that has been in the science room teaching science for a long time.

Would the Science Teachers Association be that body?

Oh yeah, yeah, yeah. People . ., well ....

....like the doctors, like the Australian Medical Association?

Yeah, yeah I think they can set their own standards, yeah.

And if there's complaints against teachers, who should handle those? Put it this way, if someone lodged a complaint about you, your science teaching, over the quality of your practice, who would you regard as the legitimate person to handle that complaint?

If there was a criteria that I was well aware of, that I should be doing in my classroom, probably to, I don't know, some sort of, I don't know, some sort of board that was set up, that could then have a look at if I'm teaching to that particular criteria.

So what, who would that be?

Well yeah, I suppose it would, you'd have to have, you know, . . . the Science Teachers Association would have to set up some sort of committee that looked at that - in setting those particular objectives - that you would then be appraised against.

By your peers more or less?

Yeah, yeah.

So this would be pretty different from what the system's always been, if the science teachers were to have some form of professional control over their own members.

I don't know what we've got at the moment. I mean to say, superintendents have been taken away from us. I didn't mind the idea of superintendents. At least there was someone there that could . . . although I can see people saying, you know, they're just one person with their particular view. Now, whether you're good or bad, that was it. At least there was someone there, there was comparability. Now there's no one. We have a consultant, but what his actual job is I'm not 100% sure of myself, what he's meant to do.

The future

It seemed that although Mike enjoyed *teaching*, the frustrations connected with bureaucratic procedures and the lack of recognition, had led him to become increasingly disillusioned with his choice of career. His attitude was one of ambivalence. When we asked him if he enjoyed teaching, he said, "yeah I've no problem coming to school", but he also said that he wouldn't recommend science teaching to the kids,

I wouldn't even tell them to be a science teacher. . . they can make a hell of a lot more money doing something else, that's for sure. Some of the people I went through with are probably making three times the amount of money I am. You know, chemists, etc, for mining companies. Although I suppose it depends on the market that's out there at the particular time. And your academic kids? Well science teaching is just not in the hunt as far as money goes, and people look at money. It's as simple as that. So I suppose, if you're going to get the more academic type of person into the classroom, you've got to offer them more money as well. But then, it gets back to that dollar sort of question doesn't it? No one seems to have any money for education.

Mike's attitude to teaching appears to have evolved from a phase of initial enthusiasm, to increasing frustration with what he regards as petty administrative procedures and lack of prospects, culminating in the decision to leave the profession.

What will you be doing in 5 to 10 years time then?

I'm at the stage now where I'm going to look at promotion. If I don't get promotion, then I don't know. I suppose, looking very cynically at that, I would look at probably getting out of teaching.

Well what would you do?

Well, this is it. Having my Bachelor of Education behind my name there's really, I don't know, I don't really know what scope there is. . . with a Bachelor of Education what else can you do apart from teaching? I'd have to have a look at it then. At this stage I would like to be in charge of a science department, be a senior master. That's where I'd like to head. But whether that will be reality, I don't know.

Interpretation

When we ask teachers for a title that captures Mike's situation and context, they have no problem in generating titles. "Over the hill - at thirty something" "Stuck in a rut", and so on. Lively discussion always follows a reading of Mike Abbott. He is a very recognisable character to teachers.

We are not intending to put Mike down here in any way. He is a committed, hard working and respected member of staff, seen as making a valuable contribution to the school. We wanted to understand the way the context within which he worked had shaped his relationship to teaching as an occupation; his views on career and status, to the relation between career development and professional development, to teaching and learning, and to evaluation, accountability and standards.

Loose Connections

Mike Abbott was just one of the science teachers we interviewed in order to understand better the kind of professonal development strategy that was needed. He is not 'typical'. Many of the teachers we interviewed, for example, were very active in their professional associations, in professional development, and well aware of recent developments in science curriculum and research, but this group would be less than a third of the teachers we interviewed.

The case of Mike Abbott makes some common themes stand out in stark relief. Like most of the teachers interviewed, he would probably remain in teaching for many years to come, but he was detached from many of the sources that might have had the potential to enhance the quality of his teaching. He saw little reason to engage in professional development from a personal point of view, and few extrinsic incentives for him to do so. He was, by and large, happy with the way he taught and he saw nothing that convinced him that he had much to get better at.

His profession had developed few models or expectations of what a science teacher should know and be able to do. There was no conception of a career as an advanced skills *science* teacher to give purpose and direction to his professional development.

Many teachers appeared to have few skills to evaluate their own teaching, or that of their peers. They had difficulty articulating principles guiding their approach to teaching. They had few ways to probe students' understanding of their teaching in depth. They were not be linked in any effective way with any professional norms or standards. Mike Abbott gave the impression that there were few standards in teaching, and that recognising quality in teaching was not possible. 'You did your own thing'.

He did not refer to any professional code of practice or ethics when he was asked how he knew when he had given a good lesson. As he said on several occasions, "I accept it that a person teaches different to me. That's about it."

In many interviews, such as that with Mike Abbott, it was hard to see a relationship between the personal and the collective domains of responsibility and accountability as a teacher. Little seemed to impinge on him and his practice, and he did not impinge on his

profession. There was little connection between individual and corporate action and accountability. The term 'loose connections' is intended to convey this milieu of detachment from a sense of professional community that seemed to identify Mike's situation. If there was a sense in which Mike was a professional, he was a powerless professional.

Mike did not seem to have a strong relationship to a professional community at any level; at the level of the science department, the school, the science teachers' association, his union, or the state system. These professional communities seemed to have little impact on, or control over, his practice; and he had little influence over them and their policies and practices. It did not appear that he wanted to.

He did not seem to think that he had a right to exercise some form of collective professional responsibility with his peers over matters such as the setting of standards and the evaluation of teaching at various stages of a teachers' career - although there were nascent signs of such an attitude when we asked him about assessing applicants for AST status, and who had the expertise and the right to participate.

Although Mike had considerable discretion at the classroom level, he had few opportunities to exercise any corporate control over professional matters. "They" looked after such matters. Mike's maturation had been restricted by a system that had denied him the responsibilities that would have enabled him to grow as a professional. Like many teachers we interviewed, he gave the impression of someone experiencing the growing pains of belonging to a maturing profession, with the consequent uncertainty of a future without the old authority structures.

None of the reform initiatives of the 1980s in Australia, admirable as many had been, had done much to alter this situation. As mentioned earlier, the status and self-esteem of teachers has declined significantly over a period of considerable government initiated educational reform. Maybe we need more research to understand the impact that central policy-making has on local initiative and engagement, and the sense of corporate professional responsibility among teachers.

'Loose connections' is an organisational control perspective on teachers' work that reflects the isolation of teachers from a range of influences on their professional development and the quality of their work. The other side of this coin is that these science teachers exercise little collective responsibility over matters concerning quality of practice, possess few professional norms, and, partly as a consequence, have a weakly defined concept of career development. Through this interpretation we argue that many science teachers have a weak professional identity in the sense that they are loosely connected with:-

Science and scientists

Contact with scientists, scientific journals, etc., and the activity of the wider science community generally;

A professional knowledge base

Science education theory and research on learning science; for example, that which might indicate what Advanced Skills *Science* Teachers' needed to know and be able to do;

Professional development

In-service education and other forms of support; a concept of 'what science teachers needed to get better at' which could give clear purpose and direction to professional development;

Collegiality

Regular opportunities for shared work, observation, and discussion about teaching with other teachers in the workplace;

A Sense of Efficacy

Frequent and accurate feedback about their teaching and its effects on student understanding from peers and students;

Professional identity and professional norms

Links with their professional associations and a sense of personal and collective responsibility to be involved in professional matters such as standards and the improvement of the quality of practice;

Recognition

Prospects of career development based on demonstrable advances in professional knowledge and skill;

Status

Regular intimations of respect for their work from administrators, parents, and the community;

Evaluation and Professional Standards

Engagement in the setting of professional standards to be used in teacher evaluation for career advancement- e.g. registration, permanency, promotion to Advanced Skills Teacher status.

What were the implications of 'loose connections' for a professional development strategy?

These interviews led us to believe that our strategy needed to address a broader range of concerns and a wider policy agenda than we had planned originally. We did not see our role as developing a strategy that would be equivalent to preaching to the converted. Any worthwhile strategy would have to have the capacity and the clout to make a difference to the present and future Mike Abbotts in teaching.

The public was hardly going to be impressed with schemes like Award Restructuring, career development, and the concept of the Advanced Skills Teacher, if the profession itself could not, or would not, articulate professional standards indicating what an AST should know and be able to do, and valid procedures for assessing their attainment.. Why pay for a skills-based concept of a career path if the profession only had vague ideas of what counted as quality in learning and only vague ideas about the kind of teaching that had greater likelihood to bring that learning about? If teachers wanted the public to place more value on their work then they would have to take on the job of demonstrating the complexity and sophistication - and value - of best practice.

The strategy developed by the SEPD Project fell into two main, interdependent areas:

1. Strengthening the "Professional Community" of science teaching

> Our interpretation of our research was that we needed a strategy to strengthen the role of the professional community among science teachers at all levels; at the school science department level, across schools at the district level, and at wider levels such as the state and national science teachers associations.

2. Strengthening the relationship between professional development and career development.

> There was a need to create a better career structure for practising science teachers, one that gave greater incentives and recognition for demonstrable improvement in the quality of practice. For this to happen we needed to shift to a pay system more closely geared to paying for knowledge and skill. The concept of skills-based *career development* as a teacher needed to be institutionalised as an alternative to the traditional bureaucratic career ladder model based on payment for occupying a position (Bacharach, Conley & Shedd, 1990; Lawler, 1990; Odden & Conley, 1991).

It was becoming clearer that we needed to redefine the problem that a strategy should try to address. Was the problem something to do with the provision of in-service education courses, or was it more fundamentally something to do with the diminishing attractiveness

of science teaching as a career? And, was there some connection between the impotence or irrelevance of in-service education for most of the teachers we interviewed and the fact that the career structure itself placed little value on advances in their knowledge and skill? Had a career structure that rewarded more those who taught less and less subtly undermined self esteem amongst teachers. Had it undermined confidence in the value of their work and the complexity and sophistication of their own best practices developed over many years? Had it limited their willingness to claim a specialised knowledge base for their work expressible through codified professional standards?

We came to see that there was not much point in designing very good in-service courses unless there was also a fundamental shift in the whole "economy" of the in-service education system and how it related to teachers' careers; the way it was governed and by whom, the way its goals and purposes were determined (the knowledge base), and the incentives for engaging in it. We neede to strengthen the connections between teachers and decision-making in this economy.

We were coming to believe that these were largely matters of professional concern and that the locus of authority concerning them should rest with the profession itself. If the occupation started to take collective responsibility for these matters we might have the seeds of a strategy that could enhance both the status of teaching and the impact of in-service education.

1. Professional communities

Teachers belong to a variety of professional communities (Rowan, 1991). These communities include subject departments or faculties, teams of staff working with particular groups of students, the whole staff of their school, and wider groups at state and national levels, such as unions and subject associations.

At the school and department level, students benefit when teachers have built up shared values and professional norms, when there is a strong sense of collegiality and plenty of opportunity to plan and review work together, and where there is a strong commitment to norms of continuous improvement and evaluation of departmental offerings to students. These are some of the main characteristics of professional communities. Underneath the idea of professional community is the acceptance of a degree of mutual accountability for ,and peer review of, practice.

At the wider level, professional community means that teachers' organisations take up responsibility for establishing a knowledge base for teaching and standards for quality practice to be applied at various stages in a teachers' career, such as registration, permanency and promotion to positions such as Advanced Skills Teacher. The SEPD

Project trialled three initiatives that seemed to us to have the potential to strengthen the professional community of science teachers.

The SEPD report *Professional Standards for the Teaching of Science* is one attempt to move in this direction. Leading scence educators were asked to explore what they thought an Advanced Skills Science Teacher should know and be able to do. Even though that report is only a beginning, it does show that the knowledge and skill that underpin best practice in science teaching is highly complex and sophisticated. There may not yet be a consensus about the knowledge base, but it is much more extensive than even many science teachers realise because we have rarely tried to articulate and codify it. Because it has not been codified, teachers themselves have tended to underestimate and lack confidence in the extent of their own specialist knowledge. It is practical knowledge about how to teach particular scientific concepts, about how students learn science, about how to plan curricula, about how to probe student understanding, and much more.

The school science department is a professional community. The SEPD Project team developed a set of resources called *Where Do We Start?: Professional Development Resources for Science Departments?* These materials and ideas for in-service activities were aimed at science teachers who wanted to make their workplace and regular science department meetings to be as much an opportunity for sharing ideas and professional activities as they were a time for routine adminstrative matters. These resources aimed to strengthen the professional development role of science department chairs.

As another approach to strengthening the professional community, we trialled the development of a "case literature" (Shulman, 1987) of quality science teaching and learning. We wanted to test the idea of establishing a tradition of on-going documentation and validation of exemplary practice amongst science teachers, and a vehicle for giving status and recognition to their professional knowledge. This work is reported in the SEPD Project report *Windows On Science Teaching: Case Studies of Practice.*

The aim of this component of the SEPD Project was to strengthen professional networks across schools to increase the access of science teachers to each other's best ideas. The rationale behind the development of this type of resource for professional development was simply that teachers valued other teachers' ideas and experience more highly than many other source of help. We felt that more should be done to formalise and celebrate the value of teachers' practical knowledge.

2. Aligning professional development with career development

It is widely recognised that we need a new conception of a career structure appropriate to teaching. It has to be one peculiarly suited to the nature of teaching and the context of

teachers' work, not one based, as in the past, on a bureaucratic model of management. Professionals have careers based on advances in their professional knowledge and skill, rather than careers based on rising through different jobs in an organisational hierarchy (Benveniste, 1987; Lawler, 1990). The bureaucratic model of career advancement is obviously not suited to teaching if the aim was to place more value on the practice of teaching and to enhance the attractiveness of teaching as a career. It was not serving the profession of teaching well in the case of Mike Abbott.

We needed to strengthen the connection between individual teachers such as Mike Abbott and the processes of establishing professional standards to be used in developing new skill-based career paths.

Career structures must be judged primarily in terms of their impact on the quality of students' opportunities to learn (Sykes, 1990). The necessary characteristic of any new structure we design must be that it keeps the best and brightest of our teachers close to students, encumbered as little as possible with non-educational, administrative duties. This requires a pay system and an organisational design wherein status and prestige are tied closely to those characteristics which are most central to a school's ability to achieve its purposes; the quality of teaching. Award Restructuring is the best opportunity we have at the moment for aligning careers in education much more closely with the central objectives of the education system and schools - quality learning and teaching.

In principle, Award Restructuring, through the introduction the Advanced Skills Teacher classification (AST), aims to improve the quality of education by providing career rewards to teachers for demonstrable advances in their *professional* knowledge and skills. To achieve this "productivity" aim there must be a clear link between professional development and career development. Such a link between career and quality of practice can only be forged if three conditions are met:

(i) we are confident that we know what the main dimensions of knowledge and skill are that teachers should get better at. These provide directions and standards for professional development known to be related to what our community values as quality learning;

(ii) we are confident that we have valid evaluation methods for recognising when a teacher's practice has reached the quality represented by the standards set out in (i); and

(iii) the public is prepared to pay for a career structure that is based on these professional standards. In other words, a pay system that values knowledge and skill. This is only likely to happen, we believe, when the teaching profession takes on, as its own responsibility, the long term task of developing such standards and evaluation methods.

Postscript

We interviewed many principals as well in our study. A high proportion were ex science teachers anyway. (We suspect there are more ex science teachers in Australia than practicing ones) They therefore had a valuable perspective to add to our interviews with the science teachers. We would like to end with a quote from one of those principals. He had become very active at the national level in the Principals Association.

We had been asking him about this awkward transition that appeared to be taking place, mainly as a result of government cutbacks, from bureaucratic controls to some uncertain future - the growing pains perahps of an emerging profession. He said at one point:

> I think that science teachers have to realise that they're the experts. Whereas before they tended to look at the Messiah, who was the science superintendent, and we did have had some outstanding superintendents. (I'd like to see a lot more of those sort of people getting into the teaching profession.) But the days of the god superintendent have gone, and in some ways I see it as a blessing, because the structure in schools was mirrored, a sort of faculty structure that schools consisted of a whole lot of faculties looking to their respective superintendents. And really we have to think much more broadly than that, that schools consist of students and communities and then those communities decide what is important.
>
> But we should also have experts deciding what needs to be taught in various curriculum areas. And this is where I think the science, the head of department has to show more responsibility and to say this is the sort of thing that we need to teach and he will get his impetus from his colleagues belonging to the science teachers association and other organisations like that. And that that's the group that has to replace the Superintendent.
>
> Once teachers realise that and stop going back to the good old days and sort of bemoaning their fate -that they haven't got superintendents, etc., once they realise that then I think we will get better science teaching in schools. Schools will control a lot more and people will be professionally developed by collaborative sharing of information with other experts in the field. So I think that in time it will be a good thing, although at the moment I know morale is low because they have been missing the support of the superintendent - mainly at the pastoral personal level that the superintendent used to look after them and talk about their transfers, their futures. . . .
>
> No. I think the science leaders, teachers, have to jump in there and they should get in there with relish and say, Gosh we've got a great opportunity to do something here and do it well.
>
> *Well, where do senior teachers of science look to for subject leadership.*
>
> They look to themselves as a group. They've got to develop mechanisms to develop leadership. I think they can look to the tertiary institutions as well. Perhaps they, they have been a bit narrow in the past in that they've pursued their own particular narrow faculty areas. If they realise, that they're not getting chemists coming through, or engineers coming through, and so on, then they might say hey, we've got a bit of a responsibility to get in and show some sort of leadership in the content expertise and I think there are signs of that beginning to happen, people are saying we're not getting the bums on seats that we used to, or the bums are a bit thicker than they should be, well lets get out there and look at the market. So I mean, that's forced a bit of a change, which is a good one. But that's where it should come from, from the schools initially by collaborative exercises, through associations and through tertiary institutions.
>
> *So the Science Teachers Association, would that be...?*

The STA should be a star in this area. Yes. And I think it is beginning to get organised. I think it is one of the stronger subject organisations actually that we do have. They've always been fairly good, STA, but I think they've got a bigger responsibility now.

Is there any way in which you would be worried that that might become a threat to the autonomy of the school, that perhaps the senior teacher of science, and the science teachers would see their first allegiance to STA rather than to the school?

I don't think it is a matter of first or second allegiance. I think there are allegiances to schools and STA. They are different allegiances, but not conflicting allegiances. Good schools need strong subject departments. I would see that STA would have a role to come up with pretty strong policy statements which the senior teachers should pursue in their school, by the various means that they've got. And by uniformity I think you can achieve a lot. So STA has a big role to play there and I think there should be an allegiance to STA if they're coming up with particular statements, that impact upon curriculum or curriculum delivery in schools.

Well if this idea of the advanced skills teacher comes in, what role should STA play in determining the criteria for that and even in selecting who among science teachers gets selected as advanced skills teachers?

Well I've, I don't know whether you know, but I have been at national level discussing this one. It's a can of worms, who are to be the advanced skills teachers and then the ACF says everybody's taught eight years in advanced skills teachings which is another way of getting a salary rise and perhaps that's a good thing, that teachers are underpaid and we might get more good teachers as a result. I think that if STA has a role to play, and that if individual associations have a role to play, then it would have to be a role of negotiation with the appropriate industrial bodies in the first instance. I think it would be a very difficult process for STA to try and assume some sort of inspectorial role as to go round and see how things, how people are. I think people will have to, for advanced skills teachers, have to be certain criteria. I was very impressed with the Northern Territory model of the levels of AST 1 to AST 3 and they had to jump different types of hurdles and my word by the time they got to AST 3 as it was envisaged, when they first drew up AST 3's you had to be pretty good, deliver papers at professional symposiums, that you had to give evidence of quite extensive professional development. You had to give evidence that you were a top teacher and a leader in your field and so on. All these sorts of things. I think STA could sort of put some of those things in place. I think we've got a long way to go with advanced skills teachers. It is a very difficult arena. Very devisive.

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